

CLAIMS

1. A fuel cell device comprising:

a fuel cell cooled by antifreeze solution;

5 an antifreeze circulation flow passage to allow the antifreeze solution to be circulated;

an antifreeze heater disposed in a midway of the antifreeze circulation flow passage to heat the antifreeze solution;

a water storage unit that stores water to be supplied to the fuel cell; and

10 a hot medium flow passage disposed in a water contact section of the water storage unit to allow the antifreeze solution, heated by the antifreeze heater, to flow.

2. The fuel cell device according to claim 1, further comprising:

15 a water pump drawing water, stored in the water storage unit, to an outside; and

a suction conduit heater section disposed around a periphery of a water suction conduit of the water pump to allow the heated antifreeze solution to flow.

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3. The fuel cell device according to claim 1, further comprising:

an antifreeze rectification plate disposed in the hot medium flow passage to rectify flow of the antifreeze solution.

25 4. The fuel cell device according to claim 1, wherein the hot medium flow

passage is disposed along at least a portion an inner wall of the water storage unit.

5 5. The fuel cell device according to claim 1, wherein the hot medium flow passage is formed in a plurality of stacks to allow mutually adjacent, stacked hot medium flow passage components to be sealed watertight, and the stacked hot medium flow passage components form at least a portion of a side wall of the water storage unit.

10 6. The fuel cell device according to claim 4, wherein the hot medium flow passage is formed in a spiral shape.

7. The fuel cell device according to claim 1, wherein the hot medium flow passage has an antifreeze solution inlet, through which the antifreeze
15 solution flows in, located at a higher position than an antifreeze solution outlet, through which the antifreeze solution flows out.

8. The fuel cell device according to claim 1, further comprising:
a switch-over unit expelling the antifreeze solution from the hot medium
20 flow passage to allow air to be admitted to the hot medium flow passage in place of the expelled antifreeze solution.

9. The fuel cell device according to claim 8, further comprising:
an antifreeze accommodating unit that, when the hot medium flow
25 passage is admitted with air in place of the antifreeze solution, allows the air

to expel the antifreeze solution such that the expelled antifreeze solution is accommodated.

10. The fuel cell device according to claim 8, wherein the air to be admitted
5 to the hot medium flow passage in place of the antifreeze solution includes combustion gas resulting from a combustor disposed in the antifreeze heater.

11. The fuel cell device according to claim 8, further comprising: an air
storage unit storing air to be introduced into the hot medium flow passage in
10 place of the antifreeze solution.

12. The fuel cell device according to claim 8, further comprising:
an antifreeze temperature detector detecting the temperature of the
antifreeze solution in the hot medium flow passage; wherein
15 when the temperature of the antifreeze solution is detected to fall in a
value higher than 0 °C and lower than α °C (α : heat capacity reference
temperature of the antifreeze solution), the antifreeze temperature detector
controls the hot medium change-over unit so as to allow the air to be
admitted to the hot medium flow passage in place of the antifreeze solution.

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13. The fuel cell device according to claim 1, further comprising:

a water temperature detector detecting a water temperature in the water
storage unit; and

a bypass unit bypassing the hot medium flow passage; wherein

25 when the detected water temperature exceeds a preset value, the water

temperature detector controls the bypass unit to allow the antifreeze solution to bypass the hot medium flow passage.

14. The fuel cell device according to claim 8, wherein the water storage unit
5 includes a double-layer structure composed of an inside tank component and an outside tank component, between which the hot medium flow passage is formed, and a heat insulation member with a specific gravity greater than the air and less than the antifreeze solution is moveably received in the hot medium flow passage.

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15. The fuel cell device according to claim 14, wherein the heating member includes a plurality of members smaller in size than a flow sectional area of the hot medium flow passage formed between the inside tank component and the outside tank component.

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16. The fuel cell device according to claim 1, wherein the antifreeze solution heated by the antifreeze heater heats the fuel cell and heat the water in the water storage unit while flowing through the hot medium flow passage.

20 17. A fuel cell device comprising:

a fuel cell cooled by antifreeze solution;

antifreeze circulation means for circulating the antifreeze solution;

antifreeze heating means for heating the antifreeze solution flowing through the antifreeze circulation means;

25 water storing means for storing water to be supplied to the fuel cell; and

hot medium flow passage means disposed in a water contact section of the water storing means to allow the antifreeze solution, heated by the antifreeze heating means, to flow.

- 5 18. A method of controlling a fuel cell device, the method comprising:
- preparing a fuel cell;
 - preparing a water storage unit, to store water to be supplied to the fuel cell, that has a hot medium flow passage;
 - circulating antifreeze solution to the fuel cell and the hot medium flow
 - 10 passage through an antifreeze circulation flow passage; and
 - heating the antifreeze solution flowing through the antifreeze circulation flow passage for thereby heating the water in the water storage unit.